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ON THE OCCURRENCE OF PERONOSPORA PARASITICA ON CAULIFLOWER.

BY HERMANN VON SCHRENK.

During the winter months of 1903 the cauliflower plants in a greenhouse of the Missouri Botanical Garden were universally attacked by the crucifer mildew (*Peronospora parasitica*, De Bary). The fungus made its appearance very suddenly, and within a week had spread over practically all of the plants in the affected greenhouse, attacking both the old and the young leaves. So virulent was the attack that it looked for a time as if the whole crop would be destroyed. So far as one could determine, this was the first appearance of this mildew on the cauliflower, at least for a long period of years, in the greenhouses of the Missouri Botanical Garden, and probably in the western States.

The crucifer mildew is one of the most widespread of all the mildews, having been observed on a large number of cruciferous plants. It is extremely common on many of the wild Cruciferae, appearing generally early in the spring. *Cardamine hirsuta* and *C. laciniata* are particularly subject to it, and, of cultivated plants, radishes and cabbages are frequently attacked by this fungus. Halsted* was one of the first to call attention to its occurrence on cultivated plants, particularly on radishes and cabbage. He reports finding it on *Alyssum maritimum* † and notes its occurrence on species of *Lepidium*, *Raphanus* and *Brassica*.

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* Halsted, B. D., Twelfth Annual Report, New Jersey Agricultural Experiment Station, page 248. (1892).

† Halsted, B. D., 13th Annual Report, N. J. Agr. Experiment Station, page 277. (1893).

Humphrey * reports it growing on purple topped white turnips together with *Cystopus candidus* (Pers.) Lev. McCarthy † describes briefly the appearance of a destructive stem rot or blight, which may be caused by *Peronospora parasitica* or *Albugo candida* (Pers.) O. Kze. (*Cystopus candidus*, Pers., Lev.) which are generally found together. "This disease attacks turnips, mustard, kale, collards, and various weeds belonging to the collard tribe, especially shepherd's purse or pepper grass."

The only case which appears to have been reported of the occurrence of this fungus on cauliflower, in a destructive manner, is cited by Marchal,‡ who states that *Peronospora* caused much loss in France to market gardeners, growing cauliflower that winter.

In the case of the plants of the Missouri Botanical Garden, the fungus made its appearance on the under side of the younger leaves (plate 23), distributed in irregular patches over the entire surface of the leaves. The areas immediately affected by the fungus turned white, giving the cauliflower a speckled appearance, as shown in plate 22.

The fungus grew rapidly through the tissues and after several days the entire leaf was usually affected. In the later stages the leaves dried considerably and became much torn and shriveled, as shown on plate 24.

Combative measures against this fungus have usually been attended with considerable success. McCarthy (loc. cit.) recommended removing all Cruciferae, as far as possible, from the fields, and treating the compost and stumps with lime. The plants themselves, he advises treating in the seed bed with iron sulphate, potassium sulphide, or sulphur powder, and repeating this treatment several times after transplanting to the field. Marchal, on the advice of Cornu, recommended spreading sawdust saturated with copper sulphate around the plants as a mulch. He states that where this was used, the disease was practically stopped.

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* Humphrey, J. E., 7th Report, State Agr. Exp. Sta., Amherst, Mass., page 222.

† McCarthy, Gerald, Bull. N. C. Exper. Station, No. 84, pg. 15. (1892).

‡ Marchal, E., Report on fungus diseases studied at the Agricultural Inst. of Gembloux during 1900. (Bull. Agronomique. Brussels. **17**: 4–18. 1901.)

In the case of plants affected by the *Peronospora* at the Garden, a number of sprays were used including copper sulphate, copper ammonium carbonate, and potassium sulphide. In order to make these solutions stick to the leaves small quantities of glue were added, and it was found that this formed a very effective way of holding the solutions on the leaves of the cauliflower. Good results were obtained with all of these sprays, with the exception of copper ammonium carbonate, which, while it killed the fungus, induced the formation of an enormous number of oedemata, on the lower surface of the leaves in particular. This will form the subject of another paper. The fungus disappeared during the spring months. The following winter the beds of this greenhouse were carefully treated with lime, and since that time there has been no further attack of the cauliflower in these houses.

It is of interest to note the very local and sporadic appearance of the *Peronospora parasitica* in this instance. Although careful search was made for it in other greenhouses of this vicinity, this was practically the only case where it occurred. Inquiries made in other parts of the United States, at the time, failed to show its occurrence on cauliflower at other points. This is rather striking because the fungus itself is a common one on the native wild plants in most parts of the United States, and it might be expected that it would show itself on cultivated cruciferous plants more frequently than it does. The possible explanation may lie in the fact that there are certain physiological strains on different species of cruciferous plants, similar to those recorded for *Erysiphe graminis* by Salmon.[*] Magnus[†] mentions this fungus especially as being one which is largely dependent upon the state of development of the host, citing the case where it attacks the host plant through the medium of *Albugo* galls. It is very probable that in the instance herein described, the cauliflower plants were in a condition particularly susceptible to the attack of the *Peronospora*, a condition which has not reappeared since that time.

EXPLANATION OF PLATES.

Plate 22. — Upper surface of leaf of cauliflower, showing the characteristic spots due to the growth of *Peronospora parasitica*, natural size.

Plate 23. — Lower surface of leaf, showing the tufts of the fungus, natural size.

Plate 24. — Lower surface of leaf in a more advanced stage of the disease, natural size.

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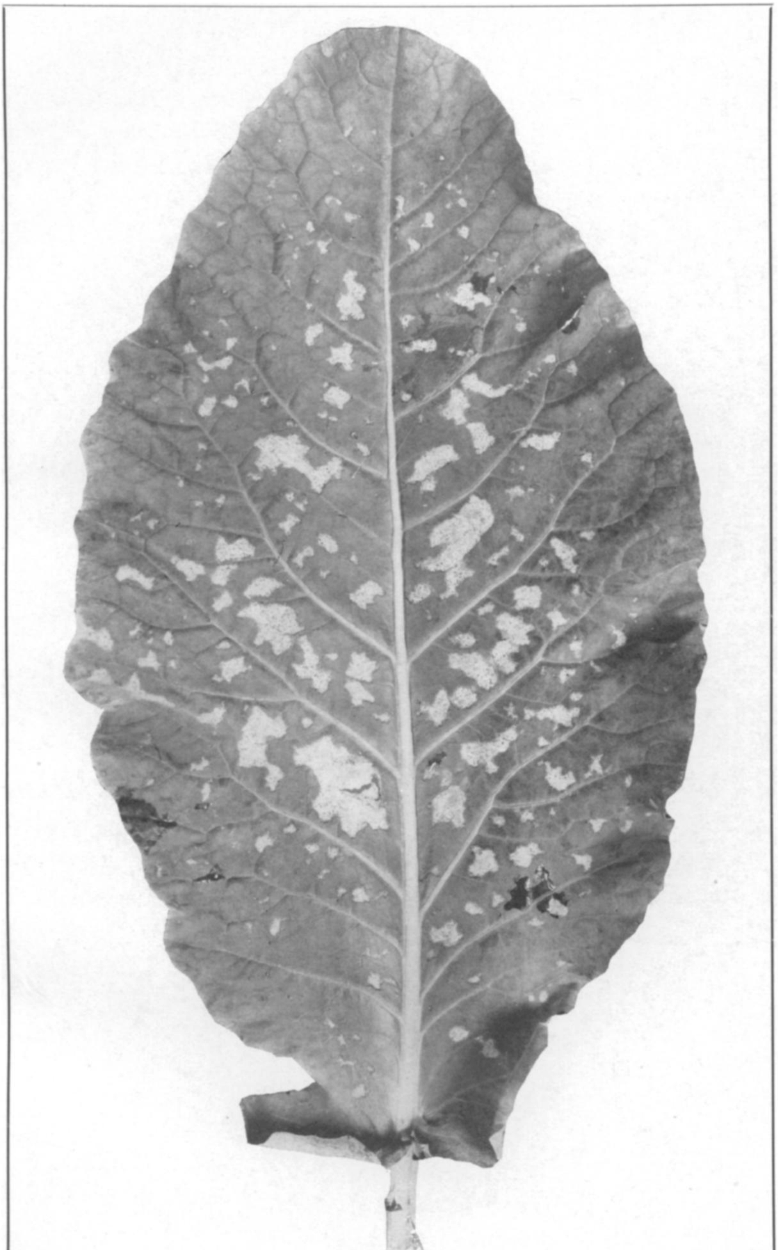
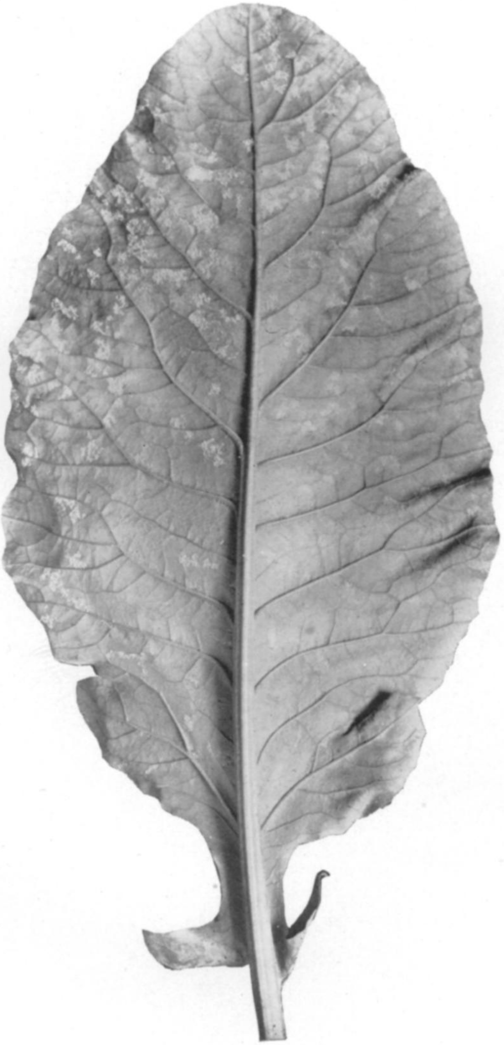
[*] Salmon, Ernest S., Cultural experiments with biologic forms of the Erysiphaceae. (Phil. Trans. **197** : 107. 1904).

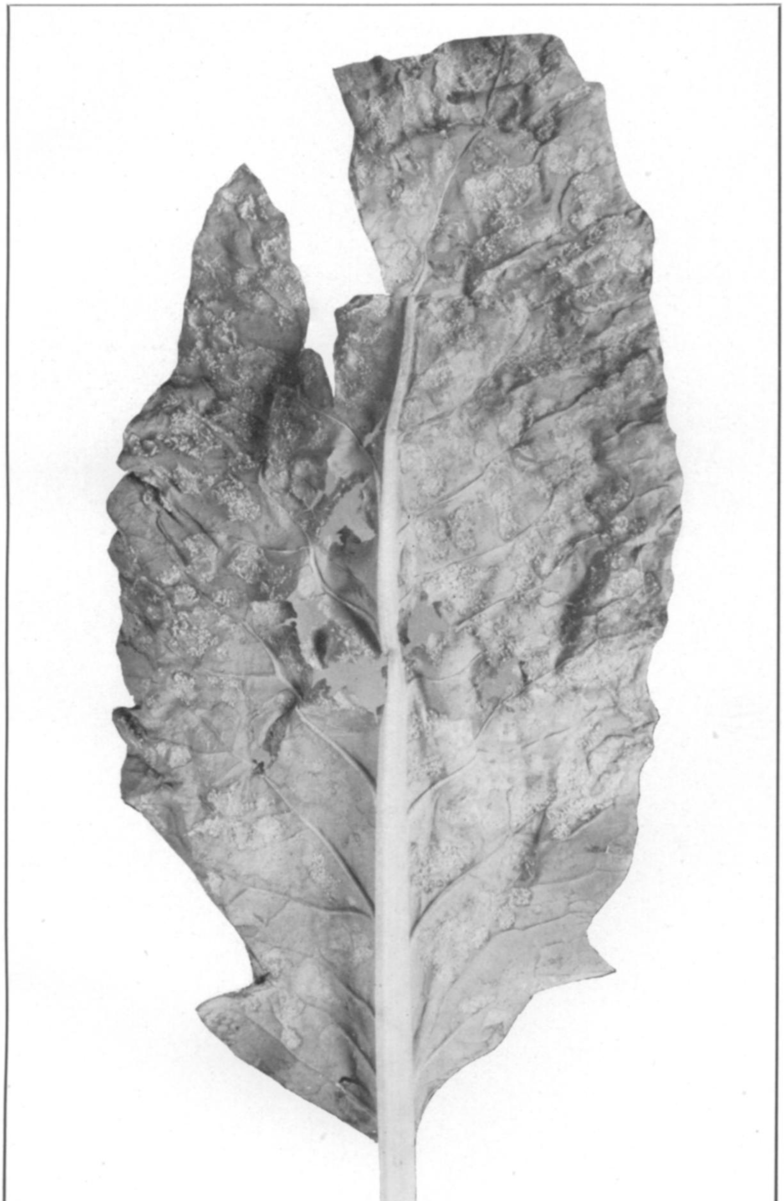
[†] Magnus, P., Das Auftreten der *Peronospora parasitica*, beeinflusst von der Beschaffenheit und dem Entwickelungszustande der Wirtspflanze. (Berichte d. d. bot. Ges. **12**. Generalversammlungsheft. pg. 39. 1894).



CAULIFLOWER ATTACKED BY PERONOSPORA.



PERONOSPORA ON CAULIFLOWER.



PERONOSPORA ON CAULIFLOWER.